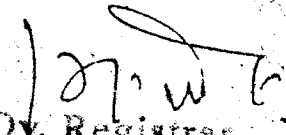


**University of Rajasthan  
Jaipur**

**SYLLABUS**

**B.Sc. Part-I**

**Examination - 2019**

  
Dy. Registrar  
(Academic)  
University of Rajasthan  
JAIPUR

## CONTENTS

### *Scheme of Examination* **SYLLABUS**

#### **Compulsory Subjects (Four)**

1. General Hindi .....
2. General English (Essential Language Skills) .....
3. Environmental Studies .....
4. Elementary Computer Application .....
5. Elementary Hindi .....
- (in lieu of General Hindi for non-Hindi speaking students only)

#### **Optional Subject :**

1. Physics .....
2. Chemistry .....
3. Zoology .....
4. Botany .....
5. Geology .....
6. **Mathematics** .....
7. Economics .....
8. Geography .....
9. Statistics .....
10. Applied Statistics .....
11. Psychology .....
12. Electronics .....

#### **Additional Optional Subjects**

1. Textile Craft
2. Garment Production and Export Management
3. Geology and Mining
4. Environmental Science

#### **Vocational Subjects**

1. Biotechnology
2. Industrial Microbiology
3. Computer Applications

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University of Rajasthan  
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## SCHEME OF EXAMINATION

### B.Sc. (Pass Course) Part-I

The number of paper and the maximum marks for each paper together with the minimum marks required for a pass are shown in the scheme of examination against each subject separately. It will be necessary for a candidate to pass in the theory part as well as the practical part of a subject/paper, wherever prescribed, separately. Classification of successful candidates shall be as follows:

|                 |     |   |
|-----------------|-----|---|
|                 |     | of the aggregate marks prescribed at (a) Part |
| First Division  | 60% | First Examination excluding those obtained    |
| Second Division | 48% | in the compulsory subject (b) Part Second     |
|                 |     | Examination (c) Part Third Examination        |
|                 |     | taken together.                               |

All the rest will be declared to have passed the examination, if they obtain a minimum pass mark in each subject viz. 36%. No division shall be awarded at the Part First and Part Second Examinations.

बी.ए. प्रथम वर्ष – (कला, विज्ञान एवं वाणिज्य संकाय)

बी.ए./बी.एस.सी./बी.कॉम./

सामान्य हिन्दी

3 Hrs duration

पृष्ठ सं. 100

न्यूनतम उत्तीर्णांक 36

नोट : 36 से कम अंक लाने पर छात्रों को उत्तीर्ण नहीं किया जायेगा। इस प्रश्न-पत्र में प्राप्त अंकों को श्रेणी निर्धारण हेतु नहीं जोड़ा जायेगा।  
अंक विभाजन – प्रश्न पत्र में दो भाग होंगे – 1. साहित्य खण्ड एवं 2. व्याकरण खण्ड। साहित्य खण्ड में दो भाग होंगे – गद्य भाग एवं पद्य भाग। प्रत्येक खण्ड के लिए 50 अंक निर्धारित है।

50 अंक

|   |   |             |        |
|---|---|-------------|--------|
| क | दो व्याख्या पद्य से (प्रत्येक में विकल्प देना है) | 5 x 2 =     | 10 अंक |
| ख | दो व्याख्या गद्य से (प्रत्येक में विकल्प देना है) | 5 x 2 =     | 10 अंक |
| ग | आलोचनात्मक प्रश्न पद्य से (विकल्प देना है)        | 7 1/2 x 2 = | 15 अंक |
| घ | आलोचनात्मक प्रश्न गद्य से (विकल्प देना है)        | 7 1/2 x 2 = | 15 अंक |

साहित्य खण्ड – 'क' :- गद्य-पद्य की निर्धारित रचनाएँ  
गद्य भाग –

- |              |   |  |
|--------------|---|--|
| 1. कहानी     | – | प्रेमचन्द – बड़े भाई साहब<br>विजयदान देथा – सिकंदर और कौआ    |
| 2. संस्मरण   | – | कन्हैयालाल मिश्र 'प्रभाकर' – बयालिस के ज्वार की उन लहरों में |
| 3. रेखाचित्र | – | रामवृक्ष बेनीपुरी – रजिया                                    |
| 4. विज्ञान   | – | गुणाकर मुले – शनि सबसे सुन्दर ग्रह                           |
| 5. निबंध     | – | अगरचन्द नाहटा – राजस्थान की सांस्कृतिक धरोहर                 |
| 6. व्यंग्य   | – | शरद जोशी – जीप पर सवार इल्लियाँ                              |
| 7. पर्यावरण  | – | अनुपम मिश्र – आज भी खरे हैं तालाब                            |

पद्य भाग :- (कबीर ग्रंथावली से सं. – श्यामसुंदर दास)

- |   |   |  |
|---|---|--|
| 1. कबीर                                   | – | साखी सं. – गुरुदेव को अंग – 7,12,26,30<br>सुमरन को अंग – 10,17,24,26<br>विरह को अंग – 2,6,10,18          |
| 2. सूरदास                                 | – | सूरसागर सार  |
|   | – | सं. डॉ. धीरेन्द्र वर्मा  |
|   | – | विनय भक्ति पद सं. – 21,33  |
|   | – | गोकुल लीला पद सं. – 55,58  |
|   | – | वृंदावन लीला पद सं. – 10,28  |
|   | – | उद्धव संदेश पद सं. – 77,79   |
| 3. तुलसीदास                               | – | विनय पत्रिका, गीताप्रेस, गोरखपुर पद सं. – 87,88,90,156,158   |
| 4. मीरा                                   | – | पदावली सं. – नरोत्तम स्वामी पद सं. – 1,3,4,5,10  |
| 5. रहीम                                   | – | रहीम ग्रंथावली संपादक विद्यानिवास मिश्र, गोविन्द रजनीश (दोहावली) 186,191,211,212,214,218,219,220,223,224 |
| 6. मैथिलीशरण गुप्त                        | – | मनुष्यता, हम राज्य लिए मरते हैं (गीत-साकेत के नवम सर्ग से)   |
| 7. सुमित्रानंदन पंत                       | – | नौका विहार   |
| 8. सूर्यकान्त त्रिपाठी निराला             | – | वह तोड़ती पत्थर  |
| 9. सच्चिदानंद हीरानंद वात्स्यायन 'अज्ञेय' | – | हिरोशिमा   |
| 10. रामधारी सिंह दिनकर                    | – | विपथगा, सगर शेष है   |

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D. P. Singh  
D. P. Singh  
University of Jammu

खण्ड - 'ख'

व्याकरण/व्यावहारिक हिन्दी खण्ड

50 अंक

|                                 |   |   |       |
|---------------------------------|---|---|-------|
| 1. निबन्ध लेखन                  | ~ | शब्द सीमा 300 शब्द  | 8 अंक |
| 2. कार्यालयी लेख                | ~ | शासकीय - अर्द्धशासकीय पत्र, कार्यालय ज्ञापन, विज्ञप्ति एवं कार्यालय आदेश, अधिसूचना, पृष्ठांकन 4 x 2 = | 8 अंक |
| 3. संक्षेपण                     | ~ |   | 4 अंक |
| 4. पल्लवन                       | ~ |   | 5 अंक |
| 5. शब्द निर्माण प्रविधि         | ~ | उपसर्ग, प्रत्यय, संधि, समास   | 5 अंक |
| 6. शब्द शुद्धि एवं वाक्य शुद्धि |   |   | 5 अंक |
| 7. मुहावरे एवं लोकोक्ति         |   |   | 5 अंक |
| 8. पारिभाषिक शब्दावली           |   |   | 5 अंक |
| 9. शब्द के प्रकार               | ~ | संज्ञा, सर्वनाम, विशेषण, क्रिया एवं क्रिया विशेषण   | 5 अंक |

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## 2. GENERAL ENGLISH

Duration: 3 hrs.

Max. Marks: 100

Minimum Pass Marks: 36

The syllabus aims at achieving the following objectives:

1. Introducing students to phonetics and enabling them to consult dictionaries for correct pronunciation (sounds and word stress)
2. Reinforcing selected components of grammar and usage
3. Strengthening comprehension of poetry, prose and short-stories
4. Strengthening compositional skills in English for paragraph writing. CVs and job applications.

The Pattern of the Question Paper will be as follows:

**Unit A: Phonetics and Translation** (20 marks)  
(10 periods)

- |   |                     |
|---|---------------------|
| I Phonetic Symbols and Transcription of Words               | (05)                |
| III Translation of 5 Simple sentences from Hindi to English | (05)                |
| from English to Hindi                                       | (05)                |
| IV Translation of 05 Words from Hindi to English            | (2 <sup>1/2</sup> ) |
| from English to Hindi                                       | (2 <sup>1/2</sup> ) |

**Unit B: Grammar and Usage** (25 marks)  
(10 periods)

- |                                |      |
|--------------------------------|------|
| i Elements of a Sentence       | (05) |
| II Transformation of Sentences | (05) |

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University of Jammu

- (a) Direct and Indirect Narration  
(b) Active and Passive Voice

II Modals (05)

III Tense (05)

IV Punctuation of a Short Passage with 10 Punctuation Marks  
(05)

(As discussed in Quirk and Greenbaum)

**Unit C: Comprehension**

**(25 marks)**

Following Essays and Stories in *Essential Language Skills* revised edition compiled by Macmillan for University of Rajasthan General English B.

A. /B. Com./B. Sc.

Candidates will be required to answer 5 questions of two lines each to be answered out of 10 questions. There would be two questions from the prescribed text. (10)

Sujata Bhatt

Voice of the Unwanted Girl

Ruskin Bond

Night Train for Deoli

M.K. Gandhi

The Birth of Khadi

J.L. Nehru

A Tryst with Destiny

A.P.J. Abdul Kalam

Vision for 2020

**The candidates will be required to answer 5 questions from the given unseen passage. (10)**

**One vocabulary question of 10 words from the given passage. (5)**

**Unit D: Compositional Skills**

**(30 marks)**

**(15 periods)**

I Letters-Formal and Informal (10)

II CV's Resume and Job Applications and Report (10)

III Paragraph Writing (10)

7.

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## Recommended Reading:

Sasikumar, V., Dutta and Rajeevan, A Course in Listening and Speaking-I Foundation Books. 2005.

Sawhney, Panja and Verma eds. English At the Workplace, Macmillan 2003.

Singh, R.P. Professional Communication. OUP. 2004

Judith Leigh. CVs and Job Applications. OUP. 2004

Arthur Waldhorn and Arthur Zeiger, English Made Simple. Upa and Co.

Gunashekar ed. A Foundation English Course for Undergraduates Book I, CIEFL, Hyderabad.

Quirk and Greenbaum: A University Grammar of English Longman, 1973



### **3. COMPULSORY PAPER OF ENVIRONMENTAL STUDIES**

Compulsory in I Year for all streams at undergraduate level

#### **Scheme of examination**

| Time  | Min Marks | Max. Marks |
|-------|-----------|------------|
| 3 hrs | 36        | 100        |

This paper will contain 100 multiple choice questions. Each question will carry 1 mark.

Students should be encouraged to visit places of Environmental Importance including Natural and Manmade Habitat.

#### **Note:**

1. The marks secured in this paper shall not be counted in awarding the division to a candidate.
2. The candidates will have to clear this compulsory paper in three chances.
3. Non-appearing or absence in the examination of compulsory paper will be counted as a chance.

#### **Unit.1: The Multidisciplinary nature of environmental studies**

Definition, scope and importance- Relationship between Environmental Studies and other branches of science and social sciences.

Need for Environmental awareness, Environmental education in present day context.

#### **Unit.2: Natural Resources and Challenges**

- a. Natural resources and associated problems, Classification of resources: renewable resources, non renewable resources, classes of earth resources, resources regions: Definition and criteria, resource conservation.
- b. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- c. Water resources: Use and over-utilization of surface and groundwater, floods, drought conflicts over water, dams-benefits and problems.
- d. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

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Mysore

- e. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, case studies.
- f. Energy resources: Growing energy need, renewable and nonrenewable energy sources, use of alternate energy sources. Case studies.
- g. Land resources: Land as a resource, Land degradation man induced Landslides, soil erosion and desertification.
  - Role of an individual in conservation of natural resources.
  - Equitable use of resources for sustainable lifestyles.

### **Unit 3: Ecosystems, Concepts, Structure, Functions and Types**

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids
- Introduction, types characteristics features, structure and function of the following ecosystem:
  - a. Forest ecosystem, Tropical Temperate and Alpine Ecosystem
  - b. Grassland ecosystem and Their Types
  - c. Desert ecosystem with emphasis on Thar Desert
  - d. Aquatic ecosystems(ponds, streams, lakes, rivers, oceans, estuaries) and Wet Lands

### **Unit 4: Biodiversity and its conservation**

- Introduction -Definition, genetic, species and ecosystem diversity
- Biogeographically classification of India
- Value of biodiversity :consumptive use, productive use, social ethical, aesthetic and option values
- Biodiversity at global, National and local level
- India as a mega-diversity nation
- Hot-spot of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
- Endangered, Threatened and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity
- Red Data Book

## Unit 5 : Environmental Pollution and Control Measures

### Definition

Causes, effects and control measures of:

- a) Air Pollution
- b) Water Pollution
- c) Soil Pollution
- d) Marine Pollution
- e) Noise Pollution
- f) Thermal Pollution
- g) Nuclear Hazards

- Solid waste management Causes, effects and control measures of urban and industrial wastes
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods earthquake, cyclone and landslides

## Unit 6 : Social issues, Environment, Laws and Sustainability

- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies
- Environmental ethics: Issues and possible solution.
- Climate change, global warming, acid rain ozone layer depletion, nuclear accidents and holocaust. Case studies
- Wasteland reclamation.
- Consumerism and waste product.
- Environmental Protection Act.
- Air (Prevention and Control of Pollution) Act
- Wild life protection Act
- Forest Conservation Act
- Biological Diversity Act
- Issues involved in enforcement of environmental legislation
- Public Awareness.

## Unit 7: Human Population and the Environment

- Population growth, variation among nations
- Population explosion-Family Welfare Programme
- Environment and Human health
- Human Rights
- Value Education
- HIV/AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and human health
- Case Studies

**Suggested Readings:-**

1. Chauhan. Surendra Singh. 2001. Biodiversity, Biopiracy and Biopolitics: The Global Perspectives, Kalinga Publications, New Delhi.
2. Chauhan. Surendra Singh. 2004. Environmental Protection and Management: From Stockholm to Rio and After, Kalinga Publications, New Delhi.
3. Diwan A.P. and Arora D.K.1995. Human Ecology Anmol Publication Pvt.Ltd.,New Delhi.
4. Dubey, R.M.1992. Human Ecology and Environmental Education,Chaugh Publications,Allahabad.
5. Goudie,Andrew.The Human Impact.
6. Husain Maxia.1994 Human Geography,Rawat Publication,Jaipur.
7. Johnston, R.J.Ed.1986 Dictionary of Human geography,National Publication,New Delhi.
8. Malik,S.L.and Bhattacharya D.K.1986. Aspects of Human Ecology,Northern Book Center,New Delhi.
9. Mishra,R.P and Bhooshan,B.S.1979.Human Settlements in Asia.Public,Polices and programmes Haritage publisher,New Delhi.
- 10.Nathawat, G.S.1985. Human Ecology,An Indian perspective,Indian Human Ecology Council,Jaipur.
- 11.Russel, Bartrand, 1976.Impact of Science of society Unwin,Publisher,Indian. (paper back).
- 12.Sinha Rajiv, 1996.Gloobal Biodiversity Ina.,Shri publication,Jaipur.
- 13.Sinha Rajiv K., 1994. Development without Desertction
- 14.Environmentalist,Jaipur. Sinha Rajiv K., 1996.Environmental Crises and Human at Risk,In A Shri Publication,Jaipur.
- 15.Smith, Dlanne, 1984.Urban Ecology,George Allen,London.
- 16.Swarnkar, R.C.1985.Indian Tribes.Printwell publisher,Jaipur.
- 17.Tivy,Joy and O'Hugegreg,1985.Human Impact on the Ecosystem Edinburgh George Allen Boyd.
- 18.United Nations Development Report, 1996.Human Development Report 1996.Oxford University Press,Delhi.
- 19.Vannathony & Rogers Paul, 1974. Human Ecology and World Development,Flehum Press,New York.

## 4. Elementary Computer Applications

Maximum Marks- 100 (Main University Examinations)

Theory : Max. Marks -60

Practical : Max. Marks- 40

Each Candidate has to pass in Theory and Practical Examinations separately.

Question paper for Elementary Computer Applications, (Compulsory paper-common for B.A. / B.Sc./ B.Com. Part-I) be so set that it has 120 multiple choice questions (Bilingual) of ½ marks each. The question paper will be of duration of 2 hours. The examinees will have to give their answers on OMR Sheet only to be provided by the University whose evaluation will be done based on OMR Scanning Technology. Further the practical examination for this paper will be of 40 marks and its duration will be of 2 hours.

### Unit – I

**Introduction to information technology :** Evolution and generation of computers, type of computers, micro , mini , mainframe and super computer. Architecture of a computer system : CPU , ALU, Memory (Ram, Rom families) cache memory, input /output devices, pointing devices.

Concept of Operating system, need types of operating systems: batch, single user, multi – processing , distributed and timeshared operating systems, introduction of Unix, Linux, Windows, Window NT. Programming languages Low level and high level languages, generation of languages , 3 GL and 4 GL languages .Graphic User Interfaces.

### Unit – II

**Word Processing tool :** Introduction , Creating, Saving, Copy, Move and Delete. Checking Spelling and Grammer. Page Layout. interfacce, toolbars, rules, menus keyboard shortcut , editing. Text Formatting, insert headers and footers. Bullets and Numbering. Find and Replace etc. Insert Table and Picture , Macro, Mail Merge.

**Power Point :** Creating and viewing a presentation, managing slide shows navigating through a presentation using hyperlinks, advanced navigation with action setting and action buttons. Organizing formats with Master Slides applying and modifying designs adding graphics , multimedia and special effects.

### Unit - III

**Electronic Spreadsheet :** Worksheet types of create and open a worksheet. Entering data text numbers and formula in a worksheet inserting and deleting cells, cell formatting, inserting rows and columns in a worksheet formatting worksheets. Using various formula and inbuilt function. Update worksheet using special tools like spell check and auto correct setup the page

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Margins of worksheets for printing. Format the data in the worksheet globally or selectively, creating charts. Enhance worksheets using charts, multiple worksheets-concepts

#### Unit - IV

The Internet - History and Functions of the Internet, Working with Internet, Web Browsers, World Wide Web, Uniform Resource Locator and Domain Names, Uses of Internet, Search for Information, Email, Chatting, Instant messenger services, News, Group, Teleconferencing, Video-Conferencing, E-Commerce and M-Commerce.

Manage an E-mail Account, E-mail Address, configure E-mail Account, log to an E-mail, Receive E-mail, Sending mails, sending files an attachments and Address Book, Downloading Files, online form filling, E-Services - E-Banking and E-Learning.

#### Unit - V

Social, Ethical and Legal Matters - Effects on the way we: Work Socialise, Operate in other areas, Cyber crime, Prevention of crime, Cyber law: Indian IT Act, Intellectual property, Software piracy, Copyright and Patent, Software licensing, Proprietary software, Free and Open source software.

Network Security - Risk assessment and security measures, Assets and types (data, applications, system and network), Security threats and attacks (passive, active); types and effects (e.g. Identity theft, denial of services, computer virus etc.), Security issues and security measures (Firewalls, encryption/decryption), Prevention.

#### Question Paper pattern for Main University Practical Examination

Max Marks: 40

#### Practical

The practical exercises will be designed to help in the understanding of concepts of computer and the utilization in the areas outlined in the theory syllabus. The emphasis should be on practical usage rather than on theoretical concepts only.

The practical examination scheme should be as follows -

- Three Practical Exercise (including Attendance & Record performance) 30 marks
  - Operating system
  - MS Word
  - MS Excel
  - MS Power Point
  - Internet
- Viva-voce 10 marks

14.

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# 5 बी.ए. प्रथम वर्ष : प्रारम्भिक हिन्दी

अवधि : 3 घण्टे

## अंकों का विभाजन

- |                              |        |
|------------------------------|--------|
| 1. पुस्तकों पर आधारित प्रश्न | 50 अंक |
| 2. व्याकरण से संबंधित प्रश्न | 24 अंक |
| 3. रचना से संबंधित प्रश्न    | 26 अंक |
| (क) लोकोक्तियाँ मुहावरे      |        |
| (ख) पत्र लेखन अथवा निबंध     |        |

## पाठ्यक्रम

1. गद्य संग्रह
2. व्याकरण : शब्द विचार, वाक्य विन्यास, वाक्य खण्ड, पद क्रम का ज्ञान तथा इनमें होने वाली सामान्य त्रुटियों का ज्ञान।
3. (क) मुहावरों एवं लोकोक्तियों का प्रयोग, वाक्यों में रिक्त स्थानों की पूर्ति, समान दिखने वाले शब्दों का अर्थ भेद अथवा वाक्यों में प्रयोग  
(ख) पत्र लेखन अथवा निबंध

## पाठ्य पुस्तकें

1. गद्य-संग्रह-राष्ट्रीय गौरव के चिन्ह- डॉ. हरिकृष्ण देवसरे  
प्रकाशक-नेशनल पब्लिशिंग हाउस, नई दिल्ली

## व्याकरण एवं रचना

1. आधुनिक हिन्दी व्याकरण तथा रचना - लेखक कृष्ण विकल  
प्रकाशक-नेशनल पब्लिशिंग हाउस, नई दिल्ली
2. सुबोध व्याकरण एवं रचना-सम्पादक-व्यथित हृदय-संशोधनकर्ता-डॉ.अम्बा प्रसाद सुमन  
प्रकाशक - श्रीराम मेहरा एण्ड कम्पनी, आगरा

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## B.Sc. Part I (Pass Course)

### I. PHYSICS

Scheme :

Max. Marks: 100

Min. Pass Marks: 36

|           |                 |                |                    |
|-----------|-----------------|----------------|--------------------|
| Paper I   | 3 hrs. duration | Max. Marks: 33 | Min. Pass marks 12 |
| Paper II  | 3 hrs. duration | Max. Marks: 33 | Min. Pass marks 12 |
| Paper III | 3 hrs. duration | Max. Marks: 34 | Min. Pass marks 12 |
| Practical | 5 hrs. duration | Max. Marks: 50 | Min. Pass marks 18 |

### Paper-I : Mechanics & Oscillations

Work Load: 2 hrs. Lecture /week

Examination Duration: 3 Hrs.

**Scheme of Examination:** First question will be of nine marks comprising of six parts of short answer type with answer not exceeding half a page. Remaining four questions will be set with one from each of the unit and will be of six marks each. Second to fifth question will have two parts namely (A) and (B) each carrying 3 marks. Part (A) of second to fifth question shall be compulsory and Part (B) of these questions will have internal choice.

#### Unit - I:

##### Physical Law and frame of Reference

- Inertial and non-inertial frames, Transformation of displacement, velocity, acceleration between different frames of reference involving translation. Galilean transformation and invariance of Newton's laws.
- Coriolis Force:** Transformation of displacement, velocity and acceleration between rotating frame, Pseudo forces, Coriolis force, Motion relative to earth, Foucault's pendulum.
- Conservative Forces:** Introduction about conservative and non-conservative forces, Rectilinear motion under conservative forces, Discussion of potential energy curve and motion of a particle.

#### Unit - II:

##### Centre of Mass

Introduction about Centre of Mass, Centre of Mass Frame: Collision of two particles in one and two dimensions (elastic and inelastic), Slowing down of neutrons in a moderator, Motion of a system with varying mass, Angular momentum concept, conservation and charge particle scattering by a nucleus.

Rigid body

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Equation of a motion of a rotating body. Inertial coefficient. Case of  $J$  not parallel to  $\omega$ . Kinetic energy of rotation and idea of principal axes. Precessional motion of a spinning top.

#### Unit - III:

##### **Motion under Central Forces**

Introduction about Central Forces. Motion under central forces. Gravitational interaction. Inertia and gravitational mass. General solution under gravitational interaction. Keplers Laws. Discussion of trajectories. Cases of elliptical and circular orbits. Rutherford scattering.

##### **Damped Harmonic Oscillations**

Introduction about oscillations in a potential well. Damped force and motion under damping. Damped Simple Harmonic Oscillator. Power dissipation. Anharmonic oscillator and simple pendulum as an example.

#### Unit - IV:

##### **Driven Harmonic Oscillations**

Driven harmonic oscillator with damping. Frequency response. Phase relationship. Quality factor. Resonance. Series and parallel of LCR circuit. Electromechanical systems. Galvanometer.

##### **Coupled Oscillations**

Equation of motion of two coupled Simple Harmonic Oscillators. Normal modes motion in mixed modes. Transient behavior. Dynamics of a number of oscillators with neighbor interactions.

#### Text books:

- Mechanics (SI). Charles Kittel
- Introduction to Classical mechanics. TMH
- The Physics of Waves & Oscillations. Bajaj
- H. Goldstein. Classical mechanics.
- L.N. Hand, J.D. Finch. Analytical mechanics (Cambridge, 1998).
- L. Landau, E. Lifshitz. Mechanics.

### Paper - II (Electromagnetism)

Work Load: 2 Hrs. Lecture /week

Examination Duration: 3 Hrs.

Scheme of Examination: First question will be of nine marks comprising of six parts of short answer type with answer not exceeding half a page. Remaining four questions will be set with one from each of the unit and will be of six marks each. Second to fifth question will have two parts namely (A) and (B) each carrying 3 marks. Part (A) of second to fifth question shall be compulsory and Part (B) of these questions will have internal choice.

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## UNIT I: Scalar and Vector Fields

Concept of Field, Scalar and Vector Fields, Gradient of scalar field, Physical significance and formalism of Gradient, Divergence and Curl of a vector field Cartesian co-ordinates system, Problems based on Gradient, Divergence and curl operators. Concept of Solid angle, Gauss divergence and Stoke's theorem. Gauss law from inverse square law. Differential form of Gauss law.

### Electric Field and Potential Energy

Invariance of Charge, Potential energy of system of (i) Discrete N-charges (ii) Continuous charge distribution. Energy required to build a uniformly charged sphere, classical radius of electron, Electric field due to a short electric dipole, Interaction of electric dipole with external uniform and non uniform electric field, potential due to a uniformly charged spherical shell.

Poisson's and Laplace equations in Cartesian co-ordinates and their applications to solve the problems of electrostatics.

Electric field measured in moving frames, Electric field of a point charge moving with constant velocity.

### Unit II: Electric field in matter

Multipole expansion, definition of moments of charge distribution, Dielectrics, Induced dipole moments, polar non polar molecules, Free and bound charges. Polarization, Atomic polarizability, electric displacement vector, electric susceptibility, dielectric constant, relation between them.

Electric potential and electric field due to a uniformly polarized sphere (i) out side the sphere (ii) at the surface of the sphere (iii) inside the sphere, Electric field due to a dielectric sphere placed in a uniform electric field (a) out side the sphere (b) inside the sphere, Electric field due to a charge placed in dielectric medium and Gauss law. Clausius-Mossotti relation in dielectrics,

### Unit III: Magnetostatics and Magnetic field in matter

Lorentz force, properties of magnetic field, Ampere's law, field due to a current carrying solid conducting cylinder (a) out side (b) at the surface and (ii) inside the cylinder. Ampere's law in differential form, Introduction of Magnetic Vector potential, Poisson's equation for vector potential, Deduction of Bio-Savart law using Magnetic Vector potentials, Differential form of Ampere's law.

Atomic magnet, Gyromagnetic ratio, Bohr-magneton, Larmor frequency, induced magnetic moment and dia-magnetism, spin magnetic moment, para and ferro-magnetism, Intensity of Magnetization, Magnetic permeability and Susceptibility, free and bound current densities, Magnetic field due to a uniformly magnetized material and Non-uniformly magnetized material.

### Unit IV: Maxwell's Equations and Electromagnetic waves

Displacement current, Maxwell's Equations, Electromagnetic waves, Electromagnetic waves in an Isotropic medium, Properties of electromagnetic waves, Energy density of Electromagnetic waves, Poynting vector, Radiation pressure of free space, Electromagnetic waves in Dispersive medium, Spectrum of Electromagnetic waves.

### References :

1. Electricity & Magnetism ; A.S. Mahajan & Abbas A. Rangwala, Tata.McGraw-Hill
2. Introduction to Electrodynamics ;, David J. Griffith, Prentice Hall
3. Berkley Physics Course , Vol. II
4. Fundamental University Physics Vol II : Fields and Waves ; M. Alonso and E.J. Finn: Addison-Wesley Publishing Company,

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2. Introduction to Electrodynamics : David J. Griffith, Prentice Hall

3. Berkley Physics Course : Vol II

4. Fundamental University Physics Vol II : Fields and Waves : M. Alonso and E.J. Finn:  
Addison-Wesley Publishing Company.

### Paper III OPTICS

Work Load: 2 hrs. Lecture /week

Examination Duration: 3 Hrs.

**Scheme of Examination:** First question will be of nine marks comprising of six parts of short answer type with answer not exceeding half a page. Remaining four questions will be set with one from each of the unit and will be of six marks each. Second to fifth questions will have two parts namely (A) and (B) each carrying 3 marks. Part (A) of second to fifth question shall be compulsory and Part (B) of these questions will have internal choice.

#### Unit - 1 Interference:

Concept of Spatial and Temporal Coherence, coherence length, coherence time, Definition and propagation of a wave front Huygen's principle of secondary wavelets, Young's Double slit experiment. Types of interference. interference by division of wavefronts: Fresnel's Biprism. Measurement of wavelength  $\lambda$  and thickness of a thin transparent sheet. Interference by division of amplitude: Interference in thin films of constant thickness in transmitted and reflected waves. Interference produced by a wedge shaped film, Newton's rings, Determination of wavelength  $\lambda$  and refractive index  $\mu$  by Newton's Rings: fringes of equal inclination (Haidinger fringes) and equal thickness (Fizeau fringes), Michelson's Interferometer, shape of fringes, Measurement of wavelength, difference between two spectral lines and thickness of a thin transparent sheet.

#### Unit - 2 Diffraction:

Fresnel's diffraction, Half period zones, Fresnel's diffraction at a circular aperture, straight edge and a rectangular slit, Zone plate, Multiple foci of zone plate, comparison between zone plate and convex lens, Fraunhofer diffraction by single slit and a circular aperture, Fraunhofer diffraction by N parallel slits with two slits as a special case, Missing order, Plane diffraction grating and its use in determining wavelength, Dispersion by a grating, Rayleigh's criterion of resolution, Resolving power of a Telescope and a Grating.

#### Unit - 3 Polarization:

Polarization: (i) Plane polarized light (ii) Circularly polarized light and (iii) Elliptically Polarized light. Production of Plane polarized light: (i) by reflection (ii) by refraction (iii) by

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double refraction and (iv) by dichroism (Polaroid). Identification of polarized light. Huygen's theory of double refraction. Production of Circularly and Elliptically Polarized light. Quarter-wave and half wave plates. Analysis of polarized light. Optical activity. Laws of optical Activity. Fresnel's explanation of optical activity. Experimental verification of Fresnel's theory. Specific rotation. Polarimeter, Types of Polarimeter: (i) Laurent's half shade polarimeter and (ii) Biquartz polarimeter.

#### Unit - 4: Quantum Optics & Photonics

- (i) **Laser:** Spontaneous and stimulated emission, Einstein's A & B coefficients, Energy density of radiation as a result of stimulated emission and absorption, population inversion, Methods of optical pumping, energy level schemes, He-Ne, Ruby, CO<sub>2</sub> lasers.
- (ii) **Holography:** Basic concepts of Holography, principle of holography, Theory, construction and reconstruction of image, application of holography.
- (iii) **Fiber Optics:** Introduction of Optical Fiber, Necessity of Cladding, Optical fiber system, optical fiber cable, Total internal Reflection, Explanation of Propagation of light through an optical fiber.

#### Reference:

1. Optics by Brij Lal & Subramaniam, S. Chand.
2. Optics by D. P. Khandelwal.
3. Principles of optics by B. K. Mathur.
4. Introduction to Modern Optics by A. K. Ghatak.
5. An introduction to Modern Optics by G. R. Fowels.
6. Essentials of Lasers by Allen.

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## Practical

**Work Load: Four hours laboratory work per week**

**Examination Duration: Four hours**

**Minimum Experiments: Total sixteen taking eight from each section.**

The colleges are free to set new experiments of equivalent standard. This should be intimated and approved by the Convener, Board of Studies before the start of academic session. It is binding on the college to have experimental set up of at least sixteen experiments listed below (8 from each section). In case number of experiment performed by the student is less than sixteen, his marks shall be scaled down in final examination on pro rate basis. Laboratory examination paper will be set by the external examiner by making pairs of experiments taking one from each section out of sixteen or more experiments available at the center. Different combinations shall be given for different batch.

### Section A

1. To study the variation of power transfer by two different loads by a DC source and to verify maximum power transfer theorem.
2. To study the variation of charge and current in a RC circuit with a different time constant (using a DC source).
3. To study the behavior of a RC circuit with varying resistance and capacitance using AC mains as a power source and also to determine the impedance and phase relations.
4. To study the rise and decay of current in an LR circuit with a source of constant emf.
5. To study the voltage and current behavior of an LR circuit with an AC power source. Also determine power factor, impedance and phase relations.
6. To study the characteristics of a semi-conductor junction diode and determine forward and reverse resistances.
7. To study the magnetic field along the axis of a current carrying circular coil. Plot the necessary graph and hence find radius of the circular coil.
8. To determine the specific resistance of a material and determine difference between two small resistance using Carey Fosters Bridge.
9. To convert a galvanometer into a ammeter of a given range
10. To convert a galvanometer into a voltmeter of a given range.

### Section B

1. To study the random decay and determine the decay constant using the statistical board.
2. Using compound pendulum study the variation of time period with amplitude in large angle oscillations.
3. To study the damping using compound pendulum.

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4. study the excitation of normal modes and measure frequency splitting using two coupled oscillators.
5. To study the frequency of energy transfer as a function of coupling strength using coupled oscillators.
6. To study the viscous fluid damping of a compound pendulum and determining damping coefficient and Q of the oscillator.
7. To study the electromagnetic damping of a compound pendulum and to find the variation of damping coefficients with the assistance of a conducting lamina.
8. To find J by Callender and Barne's Method.
9. To determine Young's modulus by bending of beam.
10. To determine Y,  $\sigma$  and  $\eta$  by Searle's method.
11. To ensure Curie temperature of Monel alloy.
12. To determine modulus of rigidity of a wire using Maxwell's needle.
13. Study of normal modes of a coupled pendulum system. Study of oscillations in mixed modes and find the period of energy exchange between the two oscillators.
14. To study variation of surface tension with temperature using Jaegger's method.
15. To study the specific-rotation of sugar solution by polarimeter.

## 2. CHEMISTRY

Scheme:

Max Marks: 150

|           | Duration (hrs.) | Max. Marks | Min. Pass Marks |
|-----------|-----------------|------------|-----------------|
| Paper I   | 3               | 33         |                 |
| Paper-II  | 3               | 33         | 36              |
| Paper-III | 3               | 34         |                 |
| Practical | 5               | 50         | 18              |

Note: Ten (10) questions are to be set taking two (02) questions from each unit. Candidates have to answer any 5 questions selecting at least one question from each unit.

### CH-101 Paper I : Inorganic Chemistry (2 hrs or 3 periods/ week)

#### Unit-I

**Ionic Solids:** Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule.

**Metallic bond:** free electron, valence bond and band theories.

**Weak Interactions:** Hydrogen bonding, vander Waals forces.

#### Unit-II

**Covalent Bond:** Valence bond theory and its limitations, directional and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to  $\text{NH}_3$ ,  $\text{H}_3\text{O}^+$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{ICl}_2$ ,  $\text{H}_2\text{O}$ .

**Molecular Orbital Theory:** homonuclear and heteronuclear (CO and NO) diatomic molecules. Multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

#### Unit-III

**s-Block Elements:** Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.

**Periodicity of p-block elements:** Periodicity in properties of p-block elements with special reference to atomic and ionic radii, ionization energy, electron affinity, electronegativity, diagonal relationship, catenation.

#### UNIT-IV

**Some Important Compounds of p-block Elements:** Hydrides of boron, diborane and higher boranes, borazine, borohydrides, fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides.

**Chemistry of Noble Gases:** Chemical properties of the noble gases, chemistry of Xenon, structure and bonding in Xenon compounds.

#### Unit- V

**Nuclear Chemistry:** Fundamental particles of nucleus (nucleons); Concept of nuclides and its representation; Isotopes, Isobars and Isotones (with specific examples); Forces operating between nucleons (n-n, p-p, & n-p); Qualitative idea of stability of nucleus ( $n/p$  ratio).

**Radiochemistry:** Natural and artificial radioactivity; Radioactive disintegration series; Radioactive displacement law; Radioactivity decay rates; Half life and average life; Nuclear binding energy, mass defect and calculation of defect and binding energy; Nuclear reactions, Spallation, Nuclear fission and fusion.

### CH-102 Paper II :Organic Chemistry (2 hrs or 3 periods / week)

#### Unit-I

**Mechanism of Organic Reactions:** Homolytic and heterolytic bond cleavage. Types of reagents, electrophiles and nucleophiles. Reactive intermediates - carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Types of organic reactions. Energy considerations. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

#### Unit-II

**Stereochemistry of Organic Compounds:** Concept of isomerism, Types of isomerism, Difference between configuration and conformation, Flying wedge and Fischer projection formulae.

**Optical Isomerism:** Elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity. Properties of enantiomers, chiral and achiral molecules with two stereogenic centres. Diastereomers, threo and erythro isomers, meso compounds. Resolution of enantiomers. Inversion, retention and racemization (with examples).

Relative and absolute configuration, sequence rules, D / L and R / S systems of nomenclature.

**Geometric Isomerism:** Determination of configuration of geometric isomers - cis / trans and E / Z systems of nomenclature. Geometric isomerism in oximes and alicyclic compounds.

**Conformational Isomerism:** Newman projection and Sawhorse formulae, Conformational analysis of ethane, *n*-butane, cyclohexane.

#### Unit-III

**Alkanes and Cycloalkanes:** IUPAC nomenclature of branched and unbranched alkyl group, classification of carbon atoms in alkanes. Methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids). Physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation - orientation, reactivity and selectivity. Cycloalkanes - nomenclature, methods of formation, chemical reactions. Baeyer's strain theory and its limitations. Theory of strainless rings.

**Alkenes, Cycloalkenes, Dienes and Alkynes:** Methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides. Regioselectivity in alcohol dehydration - the Saytzeff rule, Hoffmann elimination. Physical properties and relative stabilities

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Alkenes. Chemical reactions of alkenes - mechanisms involved in hydrogenation, electrophilic and free radical additions. Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with  $\text{KMnO}_4$ . Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Classification and Nomenclature of isolated, conjugated and cumulated dienes. Structure of allenes and butadiene. Methods of formation, properties, Chemical reactions - 1,2- and 1,4-additions, Diels-Alder reaction and polymerization. Structure and bonding in alkynes. Methods of formation. Chemical reactions - acidity of alkynes; mechanism of electrophilic and nucleophilic addition reactions; hydroboration-oxidation; metal-ammonia reduction, oxidation and polymerization.

#### Unit-IV

**Arenes and Aromaticity:** Nomenclature of benzene derivatives. The aryl group, aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO diagram. Aromaticity: the Huckel rule, aromatic ions - three to eight membered.

**Aromatic electrophilic substitution:** General pattern of the mechanism, role of  $\sigma$  and  $\pi$ -complexes. Mechanism of nitration, halogenation, sulphonation, mercuration. Friedel-Crafts reactions and chloromethylation. Energy profile diagrams. Activating and deactivating substituents. Directive influence - orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction.

#### Unit-V

**Alkyl and Aryl Halides:** Methods of formation of alkyl halides, chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides  $\text{S}_{\text{N}}2$  and  $\text{S}_{\text{N}}1$  reactions with energy profile diagrams.

**Polyhalogen compounds:** Chloroform, carbon tetrachloride.

Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl, allyl, vinyl and aryl halides.

### CH-103 Paper III: Physical Chemistry (2 hrs. or 3 Periods/week)

#### UNIT-I

**Mathematical Concepts:** Logarithmic relations, curve sketching, linear graphs and calculations of slopes, differentiation of functions like  $k_x$ ,  $e^x$ ,  $x^n$ ,  $\sin x$  and  $\log x$ ; maxima and minima, partial differentiation and reciprocity relations, integration of some useful/relevant functions; permutations and combinations, factorials, probability.

**Liquid State:** Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

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## UNIT- II

**Gaseous States:** Postulates of kinetic theory of gases, deviation from ideal behavior, van der Waals equation of state.

**Critical Phenomenon:** PV isotherms of real gases, continuity of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state.

**Molecular velocities:** Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule-Thomson effect.)

## UNIT- III

**Solid State:** Definition of space lattice, unit cell.

Laws of crystallography- (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements in crystals.

Basic concept of X-ray diffraction by crystals. Derivation of Bragg's equation. Determination of Crystal structure of NaCl and CsCl (Laue's method and powder method), band theory of solids. Defects in solids

## UNIT IV

**Colloidal State:** Definition of colloids, classification of colloids.

Solids in liquids (sols) properties- kinetic, optical and electrical, stability of colloids. Protective action, Hardy-Schulze law, gold number.

Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.

Liquids in liquids (emulsions): types of emulsions, preparation. Emulsifier

## UNIT V

**Chemical Kinetics:** Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction, concentration, temperature, pressure, solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions - zero order, first order, second order; pseudo order, half-life and mean-life. Determination of the order of reactions - differential method, method of integration, method of half-life period and isolation method.

Radioactive decay as a first order phenomenon.

Experimental methods of chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometry. Theories of chemical kinetics. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

Simple collision theory based on hard sphere model transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

### Practical: CH -104; Laboratory Course -I

(4 hrs or 6 periods / week)

### INORGANIC CHEMISTRY

Separation and identification of six radicals (3 cations and 3 anions) in the given inorganic mixture including special combinations.

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## ORGANIC CHEMISTRY

### Laboratory Techniques

- Determination of melting point (naphthalene, benzoic acid, urea, etc.); boiling point (methanol, ethanol, cyclohexane, etc.); mixed melting point (urea-cinnamic acid, etc.).
- Crystallization of phthalic acid and benzoic acid from hot water, acetanilide from boiling water, naphthalene from ethanol etc.; Sublimation of naphthalene, camphor, etc.

### Qualitative Analysis

Element Detection (N, S and halogens). Functional group determination (unsaturation, phenolic, alcoholic, carboxylic, carbonyl, ester, carbohydrate, amine, amide, nitro) in simple organic solids and liquids.

## PHYSICAL CHEMISTRY

(One of the following experiments should be given in the examination)

### (i) Chemical Kinetics:

- To determine the specific reaction rate of the hydrolysis of methyl acetate/ ethyl acetate catalyzed by hydrogen ions at room temperature.
- To study the effect of acid strength on the hydrolysis of an ester.
- To compare the strengths of HCl and H<sub>2</sub>SO<sub>4</sub> by studying the kinetics of hydrolysis of ethyl acetate.
- To study kinetically the reaction rate of decomposition of iodide by H<sub>2</sub>O<sub>2</sub>.

### (ii) Viscosity, Surface Tension:

- To determine the viscosity/surface tension of a pure liquid (alcohol etc.) at room temperature. (using the Ostwald viscometer/stegmometer).
- To determine the percentage composition of a given binary mixture by surface tension method (acetone & ethyl methyl ketone).
- To determine the percentage composition of a given mixture (non- interacting systems) by viscosity method.
- To determine the viscosity of amyl alcohol in water at different concentration and calculate the excess viscosity of these solutions.

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### (Instructions to the Examiners)

### CHY 104: Chemistry Practical (Pass course)

Max. Marks: 50

Duration of Exam: 5 hrs.

Minimum Pass Marks: 18

#### Inorganic Chemistry

Ex.1 Separation and identification of 3 cations and 3 anions in the mixture

#### Organic Chemistry

Ex.2 Laboratory Techniques

Ex.3 Qualitative Analysis

Detection of element and detection of functional group

#### Physical Chemistry

Ex.4 Perform one of the experiments mentioned in the syllabus.

Ex.5 Viva-voce

Ex.6 Record

Total

50

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Syllabus: B.Sc. Part-I (Pass Course)

**Zoology**

(2018-19)

Scheme:

Max. Marks: 100

Min. Pass Marks: 36

|            |                   |          |
|------------|-------------------|----------|
| Paper I    | : 3 Hrs duration  | 33 Marks |
| Paper II   | : 3 Hrs duration  | 33 Marks |
| Paper III  | : 3 Hrs duration  | 34 Marks |
| Practicals | : 4 Hrs. duration | 50 Marks |

NOTE:

1. There will be two parts of every theory question paper with a total duration of 3 hours. First part of question paper will comprise of question No. 1 containing 9 (Paper I & II) or 10 (Paper III) very short answer (Maximum 25 words) type questions, each of 1 mark. This part is compulsory to attempt. Questions should be evenly distributed covering the entire syllabus. Second part of question paper will be of long answer type questions having three sections. There will be total 9 questions (Q. No. 2 to 10) in this part, *i.e.*, three from each unit /section out of which candidate will be required to attempt any 4 questions selecting at least one question from each unit/section. Each question will carry 6 marks.
2. The candidate has to answer all questions in the main answer book only.

PAPER – I: Z-101

DIVERSITY OF ANIMALS

Section – A

**Biosystematics and Taxonomy**

1. General principles of taxonomy, concept of five kingdom scheme, international code of nomenclature, cladistics, molecular taxonomy.
2. Concept of Protozoa and Metazoa, and levels of organization.
3. Taxonomy and basis of classification of non-chordata and chordata: symmetry, coelom, segmentation and embryogeny.
4. Detailed classification of Non- chordata and Chordata (up to suborders with examples)

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### Section - B

Habitat, Habit, Morphology, Structure, \*Locomotion, Organs and Systems (Digestive, Excretory, Respiratory, \*Osmoregulation, Nervous & Reproductive), Life Cycle, \*Affinities and \*Adaptations.

Note : \* indicates wherever required

1. Protozoa : Amoeba, Entamoeba, Paramecium, Euglena, Plasmodium, Trypanosoma and Leishmania.
2. Porifera : Sycon and Leucosolenia.
3. Coelentrata: Obelia and Aurelia.

### Section - C

Habitat, Habit, Morphology, Structure, \*Locomotion, Organs and Systems (Digestive, Excretory, Respiratory, Nervous & Reproductive), Life Cycle, \*Affinities and \*Adaptations.

Note : \* indicates wherever required

1. Ctenophora : Beroe
2. Platyhelminthes ; *Fasciola hepatica* and *Taenia solium*.
3. Aschelminthes : *Ascaris*, *Dracunculus* and *Wuchereria*.
4. Annelida : Neries and Leech.

## PAPER - II: Z-102 CELL BIOLOGY AND GENETICS

### Section - A

#### Cell Biology

1. Introduction to cell: Morphology, size, shape, characteristics and structure of prokaryotic and eukaryotic animal cell; basic idea of virus and cell theory.
2. Cell membrane: Characteristics of cell membrane molecules, fluid-mosaic model of Singer and Nicholson, concept of unit membrane.
3. Cell membrane transport: Passive (diffusion and osmosis, facilitated, mediated) and active transport.
4. Cytoplasmic organelles:
  - (i) Structure and biogenesis of mitochondria; electron transport chain and generation of ATP molecules.
  - (ii) Structure and functions of endoplasmic reticulum, ribosome (prokaryotic and eukaryotic) and Golgi complex.
  - (iii) Structure and functions of lysosome, microbodies and centrioles.
  - (iv) Structure and functions of cilia, flagella, microvilli and cytoskeletal elements.

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## Section - B

### 1. Nuclear Organization:

- (i) Structure and function of nuclear envelope, nuclear matrix and nucleolus.
- (ii) Chromosomes: Morphology, chromonema, chromomeres, telomeres, primary and secondary constrictions, chromatids, prokaryotic chromosome.
- (iii) Giant chromosome types: Polytene and Lampbrush.
- (iv) Chromosomal organization: Euchromatin, heterochromatin and folded fiber model and nucleosome concept.

### 2. Nucleic Acids:

- (i) DNA structure, polymorphism (A, B and Z types) and replication (semi conservative mechanism) experiments of Messelson and Stahl: elementary idea about polymerases, topoisomerases, single strand binding proteins, replicating forks (both unidirectional and bidirectional), leading and lagging strands, RNA primers and Okazaki fragments, elementary idea about DNA repair.
- (ii) RNA structure and types (mRNA, rRNA and tRNA) and transcription.

### 3. Genetic code and translation: Triplet code, characteristics of triplet code, protein synthesis (translation).

### 4. Cell in reproduction:

- (i) Interphase nucleus and cell cycle: S, G-1, G-2 and M phase.
- (ii) Mitosis: Different stages, structure and function of spindle apparatus; anaphasic movement.
- (iii) Meiosis: Different stages, synapses and synaptonemal complex, formation of chiasmata and significance of crossing over.

## Section - C

### Genetics

1. Mendelism: Brief history of genetics and Mendel's work; Mendelian laws, their significance and current status, chromosomal theory of inheritance.
2. Chromosomal mutations: Classification, translocation, inversion, deletion and duplication; Variations in chromosome numbers; haploidy diploidy, polyploidy, aneuploidy, euploidy and polysomy.
3. Linkage and crossing over, elementary idea of chromosome mapping.
4. Genetic interaction: Supplementary genes, complementary genes, duplicate genes, epistasis, inhibitory and polymorphic genes.
5. Multiple gene inheritance: ABO blood groups and Rh factor and their significance.
6. Cytoplasmic inheritance.
7. Sex determination in *Drosophila* and man, pedigree analysis.
8. Genetic disorders: Down's, Turner's and Klinefelter's syndromes, color blindness, Hemophilia, Phenylketonuria.
9. Concept of gene: Recon, muton and cistron.

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**PAPER – III: Z-103**  
**GAMETE AND DEVELOPMENTAL BIOLOGY**

**Section – A**

**Developmental Biology: Scope and Early Events**

1. Historical review, types and scope of embryology.
2. Gametogenesis:
  - (i) Formation of ova and sperm.
  - (ii) Vitellogenesis.
3. Fertilization: Activation of ovum, essence of activation: Changes in the organization of the egg cytoplasm.
4. Parthenogenesis.

**Section – B**

**Developmental Biology: Pattern and Processes**

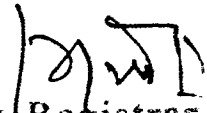
1. Cleavage: Definition, planes and patterns of cleavage among non chordates and chordates, significance of cleavage, blastulation and morulation.
2. Fate maps, morphogenetic cell movements, significance of gastrulation.
3. Embryonic induction, primary organizer, differentiation and competence.
4. Development of chick up to 96 hours stage.
5. Embryonic adaptations:
  - (i) Extra embryonic membranes in chick, their development and functions.
  - (ii) Placentation in Mammals: Definition, types, classification on the basis of morphology and histology, functions of placenta.
  - (iii) Paedogenesis and neoteny.

**Section – C**

**Dimensions in Developmental Biology**

1. Regeneration.
2. Various types of stem cells and their applications.
3. Cloning of animals:
  - (i) Nuclear transfer technique.
  - (ii) Embryo transfer technique.
4. Teratogenesis (Genetic and Induced).
5. Biology of aging.
6. Cell death.

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**B.Sc. Part - I**

**Scheme of Practical Examination and Distribution of Marks**

**Time: 4 Hrs.**

**Min Pass Marks: 18**

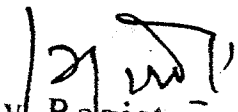
**Max. Marks: 50**

|  | Regular   | Ex. /N.C. Students |
|--|-----------|--------------------|
| 1. Anatomy (any system)                          | 6         | 5                  |
| 2. Permanent Preparation                         | 4         | 7                  |
| 3. Cell Biology and Genetics                     | 4+4       | 6+6                |
| 4. Developmental Biology                         | 6         | 5                  |
| 5. Identification and comments on Spots (1 to 8) | 16        | 16                 |
| 6. Viva Voce                                     | 5         | 5                  |
| 7. Class Record                                  | 5         | -                  |
|  | <b>50</b> | <b>50</b>          |

**Notes:**

1. Anatomy: Study of systems of the prescribed types with the help of dissection.
2. With reference to microscopic slides, in case of non-availability, the exercise should be substituted with diagrams / photographs.
3. Candidates must keep a record of all work done in the practical class and submit the same for inspection at the time of the practical examination.
4. The candidates may be asked to write detailed methodology wherever necessary and separate marks may be allocated for the same.
5. Mounting material for permanent preparations would be as per the syllabus or as available through collection and culture methods.
6. It should be ensured that animals used in the practical exercises are not covered under the wild life act 1972 and amendments made subsequently.

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**University of Rajasthan**  
**Syllabus: B.Sc. Part-I (2018-2019)**  
**Practical – Zoology**

Min. Marks: 18

4 Hrs. / Week

Max. Marks: 50

**I. Microscopic Techniques:**

1. Organization and working of Optical Microscope: Dissecting and compound microscopes.
2. General methods of microscopic slide preparations: Narcotization; fixing and preservation; washing; staining; destaining; dehydration; clearing and mounting.
3. General idea of composition, preparation and use of:
  - (i) Fixatives: Formalin, Bouin's fluid.
  - (ii) Stains: Aceto-carmine, Aceto-orcein, Haematoxylin, Eosin.
  - (iii) Common reagents: Normal saline, Acid water, Acid alcohol and Mayer's albumin.
4. Collection and Culture Methods:
  - (i) Collection of animals from their natural habitat during field trips such as *Amoeba*, *Paramecium*, *Euglena*, *Daphnia*, *Cyclops*, etc.
  - (ii) Culture of *Paramecium* in the laboratory and study of its structure, life –processes and behavior in live state.

**II. Study of Microscopic Slides and Museum Specimens:**

|                 |   |   |
|-----------------|---|---|
| Protozoa        | : | <i>Amoeba</i> , <i>Euglena</i> , <i>Trypanosoma</i> , <i>Giardia</i> , <i>Entamoeba</i> , <i>Elphidium</i> ( <i>Polystomella</i> ), <i>Foraminiferous shells</i> , <i>Monocystis</i> , <i>Plasmodium</i> , <i>Paramecium</i> , <i>leishmania</i> , <i>Paramecium</i> showing binary fission and conjugation, <i>Opalina</i> , <i>Nyctotherus</i> , <i>Balantidium</i> , <i>Vorticella</i> . |
| Porifera        | : | <i>Leucosolenia</i> , <i>Euplectella</i> , <i>Spongilla</i> , T. S. Sycon, Sponges, Spongin fibers, Gemmules  |
| Coelenterata    | : | <i>Millepora</i> , <i>Physalia</i> , <i>Veella</i> , <i>Aurelia</i> , <i>Alcyonium</i> , <i>Gorgonia</i> , <i>Pennatula</i> , Sea anemone, Stone corals, <i>Obelia</i> colony and medusa.   |
| Ctenophora      | : | Any Ctenophore  |
| Platyhelminthes | : | <i>Taenia</i> , <i>Planaria</i> , <i>Fasciola</i> (WM), T. S. body of <i>Fasciola</i> , Miracidium, Sporocyst, Redia and Cercaria Larvae of <i>Fasciola</i> , Scolex, T. S. mature proglottid of <i>Taenia</i> , gravid proglottid, <i>Cysticercus</i> larva.   |
| Aschelminthes   | : | <i>Ascaris</i> , <i>Wuchereria</i> , <i>Dracunculus</i>   |
| Annelida        | : | Neries, Heteroneries, <i>Arenicola</i> , <i>Aphrodite</i> , <i>Chaetopterus</i> , <i>Tubific</i> , <i>Glossiphonia</i> , <i>Pontobdella</i> , <i>Polygordius</i>  |

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### III. Anatomy:

- Earthworm : External features, general viscera, alimentary canal, reproductive system and nervous system.
- Leech : External features, alimentary canal, reproductive and nervous system.

### IV. Study of the Following Through Permanent Slide Preparation: *Paramecium*, *Euglena*, Foraminiferous shells, Sponge spicules, Spongin fibres, Gemmule, *Hydra*, *Obelia* colony and Medusa; Parapodium of *Nereis* and *Heteronereis*; Earthworm-ovary, testes, septal nephridia and brain ring; Leech-ovary, testes sac and salivary glands.

### V. Exercises in Cell Biology:

1. Squash preparation for the study of mitosis in onion root tip, permanent slides of mitosis (all stages).
2. Squash preparation for the study of meiosis in grasshopper or leech testes, permanent slide of meiosis (all stages).
3. Study of giant chromosomes in salivary glands of *Chironomus* or *Drosophila* larva.
4. Study of cell permeability using mammalian RBC's.

### VI. Exercises in Genetics:

#### A. Study of *Drosophila*:

1. Life cycle and an idea about its culture
2. Identification of male and female
3. Identification of wild and mutants (yellow body, ebony, vestigial wing and white eye)
4. Study of permanent prepared slides: Sex comb and salivary gland chromosomes.

#### B. Numerical problems based on monohybrid and dihybrid cross.

#### C. Identification of blood groups (A, B, AB, O & Rh factor)

### VII. Developmental Biology:

1. Study of development of frog/toad with the help of Charts/Slides/Models.
  - (i) Eggs, cleavage, blastula, gastrula, neurula, tail-bud, hatching, mature tadpole larvae, metamorphic stages, toadlet / froglet.
  - (ii) Histological slides: Cleavage, blastula, gastrula, neurula and tail-bud stage.
2. Study of development of chick with the help of whole mounts/ Charts/Slides/Models
  - (i) 18 hrs, 21 hrs, 24 hrs, 33 hrs, 48 hrs, 72 hrs and 96 hrs of incubation.
  - (ii) Primitive streak stage in living embryo, if possible, after removal of the blastoderm from the egg.
  - (iii) Study of the embryo at various stages of incubation *in vivo* by making a window in the egg-shell may also be demonstrated.
  - (iv) Study of various foetal membranes in a 10-12 day old chick embryo.

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|  |           |           |
|--|-----------|-----------|
| 3. Cell Biology and Genetics                     | 4+4       | 6+6       |
| 4. Developmental Biology                         | 6         | 5         |
| 5. Identification and comments on Spots (1 to 8) | 16        | 16        |
| 6. Viva Voce                                     | 5         | 5         |
| 7. Class Record                                  | 5         | -         |
|  | <b>50</b> | <b>50</b> |

**Notes:**

1. With reference to anatomy (Dissection), study of prescribed types and developmental biology (charts/models) candidates must be well versed in the study of various system CD ROMs multimedia computer based simulations including computer assisted learning (CAL) and other soft wares may be used.
2. With reference to permanent preparations and microscopic slides, in case of non-availability, the exercise should be substituted with diagrams, photographs, models, charts, etc.
3. Candidates must keep a record of all work done in the practical class and submit the same for inspection at the time of the practical examination.
4. The candidates may be asked to write detailed methodology wherever necessary and separate marks may be allocated for the same.
5. Mounting material for permanent preparations would be as per the syllabus or as available through collection and culture methods.
6. It should be ensured that animals used in the practical exercises are not covered under the wild life act 1972 and amendments made subsequently.

**Recommended Books:**

1. Balinsky B. I. and Fabain BC: Introduction to Embryology, CENGAGE Learning 2012.
2. Barrington EJW: The Biology of Hemichordata and Protochordata. Oliver & Boyd, London 1965.
3. Berril N. J: Development Biology, Tata McGraw Hill. 1971.
4. Colbert EH: Evolution of the Vertebrates. 2<sup>nd</sup> edition John Wiley & Sons, New York 1969
5. Colbert EH, Morales M, Minkoff EC, Colberts: Evolution of the Vertebrates: A History of the Backboned Animals Through Time. 5<sup>th</sup> edition Wiley Liss 2001.
6. Costanzo LS: Physiology. 4<sup>th</sup> edition Saunders Inc.2009.
7. Davenport R.: An Outline of Animal Development. Addison-Wesley Longman Int. 1979.

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- De Robertis EDP and De Robertis Jr EMF. Cell and Molecular Biology. 8<sup>th</sup> edition Lippincot Williams & Wilkins. 2006.
9. Gasque: CL Manual of Laboratory, Experiences Cell Biology Mc Graw-Hill Professional publishing 1989.
  10. Gilbert SF and Singer SR: Development Biology. Sinauer Associates; 9<sup>th</sup> edition. 2010.
  11. Lodish H, Berk A, Kaiser CA, Krieger M, Scott MP, Bretscher A, Ploegh H, Matsudaira P. Molecular Cell Biology. 6<sup>th</sup> edition W.H Freeman and Company, New York, 2008.
  12. Lodish H, Berk A, Kaiser CA, Krieger M, Bretscher A, Ploegh H, Amon A, Scott M P: Molecular Cell Biology. 7<sup>th</sup> edition Mac Millian High Education (International edition) England, 2013.
  13. Lodish H, Berk A, Matsudaira P, Kaiser CA, Krieger M, Scott MP, Zipursky SL, Darnell J: Molecular Cell Biology. 5<sup>th</sup> edition W.H Freeman and Company, New York, 2004.
  14. Lodish H, Berk A, Zipursky SL, Matsudaira P, Baltimore D, Darnell J: Molecular Cell Biology. 4<sup>th</sup> edition WH Freeman & Company, New York, 2000.
  15. Morgan DD: The Cell Cycle: Principles of Control. Sinauer /Panima Books, 2007.
  16. Petsko GA and Ringe D: Protein Structure and Function. Sinauer/Panima Books, 2004.
  17. Rao KV: Development Biology: A Modern Synthesis. Oxford and IBH Publishing. 1994.
  18. Rastogi VB: Animal Distribution, Evolution and Development Biology. Kedar Nath Ram Nath Educational Publishers.
  19. Singh SP and Tomar BS: Cell Biology. 10<sup>th</sup> edition Rastogi Publications, Meerut, New Delhi, 2014
  20. Snustad DP and Simmons MJ: Principles of Genetics. 4<sup>th</sup> edition John Wiley & Sons, Inc., 2005.
  21. Verma PS. A Manual of Practical Zoology: Invertebrates. S. Chand & Co. Ltd. New Delhi. 1971.
  22. Verma PS and Agarwal VK: Chordate Embryology: Development Biology. S. Chand & Company Ltd. 2012.
  23. Verma PS and Agarwal VK: Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. 14<sup>th</sup> edition, S. Chand 2004.
  24. Winchester AM: An Introduction to Genetics. Barners & Noble, Canada. 2002.
  25. Winchester AM: Genetics: A Survey of Principles of Heredity. Oxford & IBH Publishing Co., 1967.
  26. Winchester AM: Human Genetics. Ohio Charles E. Merrill Publishing Co., 1971.

# 4. BOTANY

## Scheme

Min. Pass Marks: 36

Paper I 3 hrs. Duration  
Paper II 3 hrs. Duration  
Paper III 3 hrs. Duration

Practical Min. Marks: 18 4 hrs, duration

Max Marks: 100

Max Marks 33

Max Marks 33

Max Marks 34

Max Marks 50

Duration of examination of each theory paper-

3 hours

Duration of examination of practical's-

4 hours

## Note:

1. There will be 5 questions in each paper. All questions are compulsory. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 will have 18 very short answer type Questions ( not more than 20 words) of half marks each covering entire syllabus.
3. Each paper is divided into four units. There will be one question from each unit. These Q. No. 2 to 5 will have internal choice.

**Paper-I**  
**Cell Biology, Genetics and Plant Breeding**  
**(2 hrs /week)**  
**Unit-1**

**Cell organelles and Nuclear material:** Ultrastructures and functions of different cell organelles (cell wall, plasma membrane, nucleus, mitochondria, chloroplast, ribosome, peroxisomes, Lysosome, Golgi bodies and Endoplasmic Reticulum). Chromatin structure & Chromosome organization: eukaryotic and prokaryotic. Chromosome morphology; specialized types of chromosomes (Sex chromosomes, lampbrush Chromosome, Polytene chromosome); transposons.

**Unit-2**

**Cell divisions:** Cell cycle, mitosis: stages, structure and functions of spindle apparatus; anaphasic chromosome movement; Meiosis: its different stages- Meiosis I, Meiosis II, synaptonemal complex, chiasmata formation and crossing over.

**Basis of genetic material:** Griffith's transformation experiment and The Hershey and Chase blender experiment to demonstrate DNA as the genetic material. **Concept of Gene:** *Neurospora* genetics: one gene one enzyme hypothesis;  
An idea about Prokaryotic and eukaryotic structure of gene – operon concept, exons and introns.

**Extra nuclear genome:** mitochondrial and Chloroplast genome, plasmids;

**Chromosomal aberrations:** Deletion, duplication, translocation, inversion, Aneuploidy and polyploidy.

**Unit-3**

**Genetic inheritance:** Mendel's laws of inheritance and their exceptions; allelic (incomplete and co-dominance, lethality) and non-allelic interactions (complementary genes, epistasis and duplicate genes). Quantitative inheritance : grain color in wheat, corolla length in *Nicotiana glauca*.

**Cytoplasmic inheritance-**maternal influence, shell coiling in snails, Kappa particles in *Paramecium*, Multiple allelism : ABO blood groups in men

**Unit-4**

**Plant Breeding :** Introduction and objectives of plant breeding; general methods of plant breeding- in self-pollinated, cross-pollinated and vegetatively propagated crop plants :Introduction and acclimatization, selections, hybridizations, hybrid vigour and inbreeding depression. Role of mutation and polyploidy in plant breeding. Famous Indian and international plant breeders and their contribution. National and International agricultural research institutes.

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Plant breeding work done on wheat and rice in India, Green revolution

### Suggested Laboratory Exercises.

- Study of cell structure from Onion, *Hydrilla* and *Spirogyra*.
- Study of cyclosis in *Tradescantia* spp.
- Study of plastid for pigment distribution in *Lycopersicon*, *Cassia* and *Capsicum*.
- Study of electron microphotographs of eukaryotic cells for various cell organelles.
- Study of electron microphotographs of virus, bacteria and eukaryotic cells for comparative study of cellular organization.
- Study of different stages of mitosis and meiosis in root-tip cells and flower buds respectively of onion.
- To solve genetic problems based upon Mendel's laws of inheritance: Monohybrid, Dihybrid, Back cross and test cross.
- Permanent slides/photographs of different stages of mitosis and meiosis, sex chromosomes, polytene chromosome and salivary gland chromosomes.
- Emasculation, bagging & tagging techniques
- Cross pollination techniques

### Suggested Readings:

- Choudhary, H.K. (1989). *Elementary Principles of Plant Breeding*. Oxford and IBM Publishing Co., New Delhi.
- Gupta, P.K. (2009). *Cytology, Genetics, Evolution, and Plant Breeding*, Rastogi Publications, Meerut.
- Miglani, GS. (2000). *Advanced Genetics*, Narosa Publishing House, New Delhi.
- Russel, PI. (1998). *Genetics*. The Benjamins/Cummings Publishing Co., Inc. U.S.A.
- Shukla, R.S. and Chandel, P.S. (2000). *Cytogenetics, Evolution and Plant Breeding*, S. Chand & Co. Ltd., New Delhi.
- Singh, R.B. (1999). *Text Book of Plant Breeding*, Kalyani Publishers, Ludhiana.
- Dnyansagar, VR. (1986) *Cytology and Genetics*, Tata McGraw-Hill Pub. Co. Ltd. New Delhi.
- Roy, SC. and De, KK. (1999). *Cell Biology*. New Central Book Agency (P) Ltd. Calcutta.
- Verma, PS. and Agarwal, VK. (2012). *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*. S. Chand and Co. Ltd. New Delhi.

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## Paper II

### Microbiology, Mycology and Plant Pathology

(2 hrs /week)

#### Unit-1

**Microbiology:** Meaning and Scope, history and development in the field of microbiology. Concept of quorum sensing and biofilm

**Eubacteria:** general account, occurrence, morphology (structure, shapes), flagella, capsule, nutritional types, endospore, reproduction (binary fission, transformation, conjugation, transduction), economic and biological importance.

**Mycoplasma:** occurrence, morphology, reproduction and importance.

#### Unit-2

**Virus:** General characteristics and importance. Structure of TMV and Pox virus, Structure and multiplication of Bacteriophage.

**Fungi:** General characters, occurrence, thallus organization, reproduction, economic importance. Classification of fungi (Alexopoulos and Ainsworth's).

**Plant diseases:** Biotic and abiotic diseases, important symptoms caused by fungi, bacteria, viruses and MLOs (blights, mildews- downy and powdery, rusts, smuts, canker, mosaic, little leaf, galls etc.).

#### Unit-3

Brief account, structure, importance and life history and/or disease cycle and control of the following:

*Albugo* and white rust, *Sclerospora* and Downy mildew/Green ear disease of Bajra; *Aspergillus*, *Claviceps* and Ergot; *Peziza*.

#### Unit-4

Brief account, structure, importance and life history and/or disease cycle and control of the following:

*Puccinia* and Black rust of wheat; *Ustilago* and loose smut of wheat and covered smut of barley; *Agaricus*, *Alternaria* and early blight of potato

Suggested Laboratory Exercises:

1. Study of bacteria using curd or any other suitable material, Gram's staining of bacteria.
2. Study of Mycoplasma, TMV, Poxvirus, bacteriophage (photographs/ 3-D models)
3. Study of symptoms of plant diseases: Downy mildew of Bajra, Green ear of bajra, Powdery mildew, mosaic of bhindi



4. Study of specimen, permanent slides and by making suitable temporary slides: *Albugo*- white rust; *Sclerospora*- downy mildew, green ear; *Aspergillus*; *Claviceps*- ergot; *Ustilago*- loose smut of wheat, covered smut of barley. *Puccinia*- Black rust of wheat; *Agaricus*; *Peziza* and *Alternaria*- early blight of potato *visit a local Botanical Garden / Field of study of Plant in Farms field / Agricultural Stations.*
5. Media preparation: potato dextrose agar, Nutrient agar
6. Culture techniques of fungi and bacteria.

#### Suggested Books:

- Alexopoulos, C.J. and Mims, C.W.: Introductory Mycology, John Wiley and Sons, New York. 2000
- Dube, H.C.: Fungi, Rastogi Publication, Meerut, 1989.
- Sarabhai, R. C. and Saxena, R.C.: A text book of Botany, Rastogi Publication, Meerut, 1990.
- Sharma, O.P.: Fungi, Today and Tomorrow Printers and Publishers, New Delhi, 2000.
- Vashihsta. B.R. Botany for Degree Students -Fungi, S. Chand & Co., New Delhi, 2001.
- Bilgrami, K.S. and Dube, H.C.: A text book of Modern Plant Pathology, Vikas Publications, New Delhi 2000.
- Biswas, S.B. and Biswas, A.: An Introduction to Viruses, Vikas Publications, New Delhi. 2000.
- Clifton, A.: Introduction of Bacteria, McGraw Hill Co. Ltd., New York, 1985.
- Madahar, C.L.: Introduction of Plants Virus, S. Chand and Co., New Delhi, 1978.
- Palzar M.J Jr. Chan, E.C.S. and Krieg, N.R. : Microbiology, McGraw Hill Edu. Pvt. Ltd., London 2001.
- Purohit, S.S.: Microbiology, Agro. Bot. Publication, Jodhpur 2002.
- Sharma, P. D.: Microbiology and Pathology, Rastogi Publication. Meerut, 2003.
- Singh. V. and Srivastava V. : Introduction of Bacteria, Vikas Publication, 1998.
- Cappuccino. J. and Sherman, N.: Microbiology: A Laboratory Manual (10<sup>th</sup>Ed.). Benjamin Cummings, 2013.
- Aneja, K.R.: Experiments in Microbiology, Plant Pathology and Biotechnology New Age International (P) Ltd., Publishers, New Delhi 2003.
- Mehrotra, R.S. and Aggarwal, Ashok. Plant pathology, Tata McGraw-Hill Education, 2003.

Paper III  
Algae, Lichens and Bryophyta  
(2 hrs/week)

Unit-1

General characters, Classifications (Smith). Diverse Habitat. Range of thallus structure, photosynthetic pigments and Food reserves. Reproduction (Vegetative, Asexual, Sexual). Types of the life cycle: Economic importance.

Unit-2

Type Studies

Cyanophyceae - *Oscillatoria*, *Nostoc*

Chlorophyceae - *Volvox*, *Chara*

Xanthophyceae - *Vaucheria*

Phaeophyceae - *Ectocarpus*

Rhodophyceae - *Polysiphonia*

Unit-3

General characters, Origin, and evolution of Bryophyta. Classification (Eichler); Habitat, Range of thallus structure, Reproduction (Vegetative and Sexual); Alternation of generations; Economic importance.

Type Studies: Hepaticopsida - *Riccia*, *Marchantia*

Unit-4

Type Studies: Anthocerotopsida - *Anthoceros*, Bryopsida - *Funaria*

Lichens - General characters, habitat, Structure, reproduction and economic and Ecological importance of lichens.

Suggested Laboratory Exercises

- 1 Study of class work material by making suitable temporary slides and study of permanent slides of:  
*Oscillatoria*, *Nostoc*, *Volvox*, *Chara*, *Vaucheria*, *Ectocarpus*, *Polysiphonia*.
- 2 Study of external morphology and preparation of suitable sections of vegetative/reproductive parts of *Riccia*, *Marchantia*, *Anthoceros*, *Funaria*.
- 3 Study of lichens.

Suggested Readings

- Bold, H.C. Alexopoulos, C.J. and Delevoryas, T. Morphology of Plant and Fungi (4th Ed.) Harper & Foul Co., New York, 1980.
- Ghemawat, M.S., Kapoor, J.N. and Narayan, H.S. A text book of Algae, Ramesh Book Depot, Jaipur, 1976.
- Gilbert, M. Smith: Cryptogamic Botany, Vol. I & II (2nd Ed.) Tata McGraw Hill. Publishing Co. Ltd., New Delhi, 1985.
- Kumar, H.D.: Introductory Phycology, Affiliated East—West Press, Ltd. New York, 1988.
- Puri, P.: Bryophytes, Atmaram & Sons. Delhi, Lucknow, 1985.
- Sarabhai, R.C. and Saxena, R.C.: A text book of Botany. Vol I & II, Ratan Prakashan Mandir, Meerut, 1980.
- Singh, V., Pande, P.C. and Jain, D.K.: A text book of Botany, Rastogi, & Co., Meerut, 2001.
- Vashista, B.R.: Botany for Degree Students (Algae, Bryophytes) S. Chand & Co., New Delhi, 2002.

BOTANY PRACTICAL EXAMINATION B. Sc PART-I

SKELETON PAPER

M.M. 50

TIME: 4 Hours

| S.No. | Practical  | Regular | EX NC |
|-------|--|---------|-------|
| 1(a)  | Prepare the acetocarmine stained slide of the material "A" provided to you. Draw a well labelled diagram of any one stage of nuclear division. Identify it giving reasons. | 5       | 5     |
| 1(b)  | Comment and solve the problem on Genetics allotted to you along with reasons.  | 5       | 5     |
| 2     | Make suitably stained glycerine-preparation of any one alga from the given mixture "B". Draw its labelled diagrams; assign it to its systematic position giving reasons.   | 5       | 5     |
| 3     | Make suitable preparation of the reproductive structure of material "C" (Fungi). Draw labelled diagrams. Identify giving reasons.  | 5       | 5     |
| 4     | Make suitable stained preparation of material "D" (Bryophyta (vegetative/ reproductive). Draw labelled diagrams. Identify giving reasons.                                  | 5       | 5     |
| 5     | One Microbiology experiment for comments. Or Gram's staining.  | 5       | 5     |
| 6     | Comment upon spots (1-5)   | 10      |       |
| 7     | Viva-Voce  | 5       |       |
| 8     | Practical record   | 5       |       |
|       | TOTAL  | 50      | 50    |

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# 6. MATHEMATICS

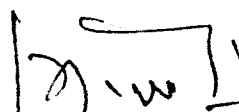
Teaching : 3 Hours per Week per Theory Paper.  
2 Hours per Week per Batch for Practical  
(20 candidates in each batch)

**Examination:**

| Scheme:            | Min.Pass Marks                                       |                           | Max. Marks                                    |
|--------------------|--|---------------------------|---|
|                    | Science - 54   |                           | 150   |
|                    | Arts - 72  |                           | 200   |
| <b>Paper - I</b>   | <b>Discrete Mathematics</b>                          | <b>Duration</b><br>3 hrs. | <b>Max.Marks</b><br>40 (Science)<br>53 (Arts) |
| <b>Paper - II</b>  | <b>Calculus</b>                                      | 3 hrs.                    | 40 (Science)<br>53 (Arts)                     |
| <b>Paper - III</b> | <b>Analytic Geometry and<br/>Optimization Theory</b> | 3 hrs.                    | 40 (Science)<br>54 (Arts)                     |
| <b>Practical</b>   | <b>Optimization Techniques</b>                       | 2 hrs.                    | 30 (Science)<br>40 (Arts)                     |

**Note:**

1. Common paper will be set for both the Faculties of Social Science and Science. However, the marks obtained by the candidate in the case of Faculty of Social Science will be converted according to the ratio of the maximum marks of the papers in the two Faculties.
2. Each candidate is required to appear in the Practical examination to be conducted by internal and external examiners. External examiner will be appointed by the University and internal examiner will be appointed by the Principal in consultation with Local Head/Head, Department of Mathematics in the college.
3. An Internal/external examiner can conduct Practical Examination of not more than **100 (Hundred) Candidates.**(20 candidates in each batch)
4. Each candidate has to pass in Theory and Practical examinations **separately.**

  
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**Paper – 1: Discrete Mathematics**  
**Teaching : 3 Hours per Week**  
**Duration of Examination : 3 Hours**

**Max. Marks: 40 (Science)**  
**53 (Arts)**

**Note:** This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

**Unit 1 :** Sets, Cardinality, Principal of inclusion and exclusion, Mathematical induction. Relations and Functions- Binary relations, Equivalence relations and Partitions, Partial ordered relations and Lattices, Chains and Antichains, Pigeon Hole principle.

**Unit 2:** Boolean Algebras- Lattices and Algebraic structure, Duality, Distributive and Complemented Lattices. Boolean Lattices, Boolean functions and expressions. Fundamental theorem of arithmetic, divisibility in  $\mathbb{Z}$ , Congruences, Chinese Remainder Theorem, Euler's  $\phi$ -function, primitive roots.

**Unit 3:** Logic and Propositional Calculus. Propositions. Simple and compound. Basic Logical operations, Truth tables, Tautologies and contradictions, Propositional Functions, quantifiers.

Discrete numeric functions and Generating functions. Recurrence relations and Recursive Algorithms – Linear Recurrence relations with constant coefficients. Homogeneous solutions. Particular solution. Total solution. Solution by the method of generating functions.

**Unit 4:** Graphs – Basic terminology, Multigraphs, Weighted graphs. Paths and circuits, Shortest paths, Introduction to Eulerian and Hamiltonian Graphs. Travelling Salesman problem. Union, Join, Product and composition of graphs. Planar graphs and Geometric dual graphs.

**Unit 5:** Trees – Properties, Spanning tree, Binary and Rooted tree. Digraphs – Simple digraph, Asymmetric digraphs, Symmetric digraphs and complete digraphs. Digraph and Binary relations. Matrix representation of graphs and digraphs.

**Reference Books:**

1. V.K. Balakrishnan, Introductory Discrete Mathematics, Prentice-Hall, 1996.
2. N. Deo, Graph Theory with Applications to Computer Science, Prentice-Hall of India.
3. S. Wiitala, Discrete Mathematics: A Unified Approach, McGraw-Hill Book Co.
4. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co., 1995.
5. Ian Anderson, A First course in Combinatorial Mathematics, Springer, 1989.
6. C.L. Liu, Elements of Discrete Mathematics, (Second Edition), McGraw Hill, International Edition, 1986.
7. Kenneth H. Rosen, Discrete Mathematics and Its Applications, Tata Mc-Graw Hills, New Delhi, 2003.

**Paper- II: Calculus**

**Teaching : 3 Hours per Week**

**Duration of Examination : 3 Hours**

**Max. Marks: 40 (Science)**

**53 (Arts)**

**Note:** This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

**Unit 1:** Series – Infinite series and Convergent series. Tests for convergence of a series – Comparison test, D'Alembert's ratio test, Cauchy's n-th root test, Raabe's test, De-Morgan-Bertrand's test, Cauchy's condensation test, Gauss's test, (Derivation of tests is not required). Alternating series. Absolute convergence. Taylor's theorem. Maclaurin's theorem. Power series expansion of a function. Power series expansion of  $\sin x$ ,  $\cos x$ ,  $e^x$ ,  $\log_e(1+x)$ ,  $(1+x)^n$ .

**Unit 2:** Derivative of the length of an arc. Pedal equations. Curvature – Various formulae. Centre of curvature and Chord of curvature. Partial differentiation. Euler's theorem for homogeneous functions. Chain rule of partial differentiation. Total differentiation. Differentiation of implicit functions.

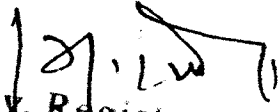
**Unit 3:** Envelopes and evolutes, Maxima and Minima of functions of two variables. Lagrange's method of undetermined multipliers. Asymptotes. Multiple points. Curve tracing of standard curves (Cartesian and Polar curves).

**Unit 4:** Beta and Gamma functions. Reduction formulae (simple standard formulae). Double integrals in Cartesian and Polar Coordinates, Change of order of integration. Triple integrals. Dirichlet's integral.

**Unit 5:** Areas, Rectification, Volumes and Surfaces of solids of revolution.

**Reference Books:**

1. Chandrika Prasad and Gorakh Prasad, A Text Book on Differential Calculus, Pothishala Pvt. Ltd., Allahabad, 1992.
2. Chandrika Prasad and Gorakh Prasad, A Text Book on Integral Calculus, Pothishala Pvt. Ltd., Allahabad, 1992.
3. Shanti Narayan and P.K. Mittal, Differential Calculus, S. Chand & Co., N. D., 2013.
4. Shanti Narayan and P.K. Mittal, Integral Calculus, S. Chand & Co., N. D., 2013
5. H.S.Dhami, Differential Calculus, Age Int. Ltd., New Delhi, 2012.
6. M. J. Strauss, G. L. Bradley and K. J. Smith, Calculus (3rd Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
7. H. Anton, I. Bivens and S. Davis, Calculus (7th Edition), John Wiley and sons (Asia), Pt Ltd., Singapore, 2002.
8. G.B. Thomas, R. L. Finney, M. D. Weir, Calculus and Analytic Geometry, Pearson Education Ltd, 2003.

  
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**Paper-III: Analytic Geometry and Optimization Theory**

**Teaching: 3 Hours per Week**

**Duration of Examination: 3 Hours**

**Max. Marks: 40 (Science)**

**54 (Arts)**

**Note:** This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

**Unit 1: Polar equation of conics, Polar equation of tangent, normal and asymptotes, chord of contact, auxiliary circle, director circle of conics**

**Unit 2: Sphere, Cone.**

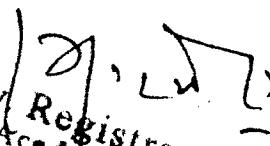
**Unit 3: Cylinder, Central Conicoids – Ellipsoid, Hyperboloid of one and two sheets, tangent lines and tangent planes. Direct sphere, Normals.**

**Unit 4: Generating lines of hyperboloid of one sheet and its properties. Reduction of a general equation of second degree in three-dimensions to standard forms.**

**Unit 5: The linear programming problem. Basic solution. Some basic properties and theorems on convex sets. Fundamental theorem of L.P.P. Theory of simplex method only. Duality. Fundamental theorem of duality, properties and elementary theorems on duality only.**

**Reference Books:**

1. S.L. Loney, The Elements of Coordinate Geometry, Macmillan and co London, 1895.
2. R.J.T. Bell, Elementary Treatise on Co-ordinate geometry of three dimensions, Macmillan India Ltd., 1994.
3. N.Saran and R.S.Gupta, Analytical geometry of Three Dimensions, Pothishala Pvt. Ltd., Allahabad, 1992.
4. P.K. Jain and Khalil Ahmed, A Text Book of Analytical geometry of Three Dimensions, Wiley-Eastern Ltd., 2000.
5. G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.
6. Hamdy A. Taha, Operations Research, An Introduction (9th edition), Prentice-Hall, 2010.

  
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**Practical: Optimization Techniques**  
**Teaching: 2 Hours per Week**

|                                    |   |                          |                 |
|------------------------------------|---|--------------------------|-----------------|
| <b>Examination:</b>                |   | <b>Duration: 2 Hours</b> |                 |
| Scheme                             |   | Science                  | Arts            |
| Max.Marks                          |   | 30                       | 40              |
| Min.Pass Marks                     |   | 10                       | 13              |
| <b>Distribution of Marks:</b>      |   |                          |                 |
| Two Practicals one from each group |   |                          |                 |
| 10 Marks each                      | = | 20 Marks                 | (13 Marks each) |
| Practical Record                   | = | 05 Marks                 | 26              |
| Viva-voce                          | = | 05 Marks                 | 07              |
| Total Marks                        | = | 30 Marks                 | 07              |
|                                    |   |                          | 40              |

**Group A:** Modelling of industrial and engineering problems into LPP and its dual and their solution by Simplex Method.

**Group B:** Modelling of industrial and engineering problems into Assignment Problems and Transportation Problems and their solutions.

**Note:**

1. Problems will be solved by using Scientific Calculators (non-Programmable)
2. Candidates must know about all functions and operations of Scientific Calculator.
3. Each Candidate (Regular/non-Collegiate) has to prepare his/her practical record.
4. Each Candidate has to pass in Practical and Theory examinations separately.

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